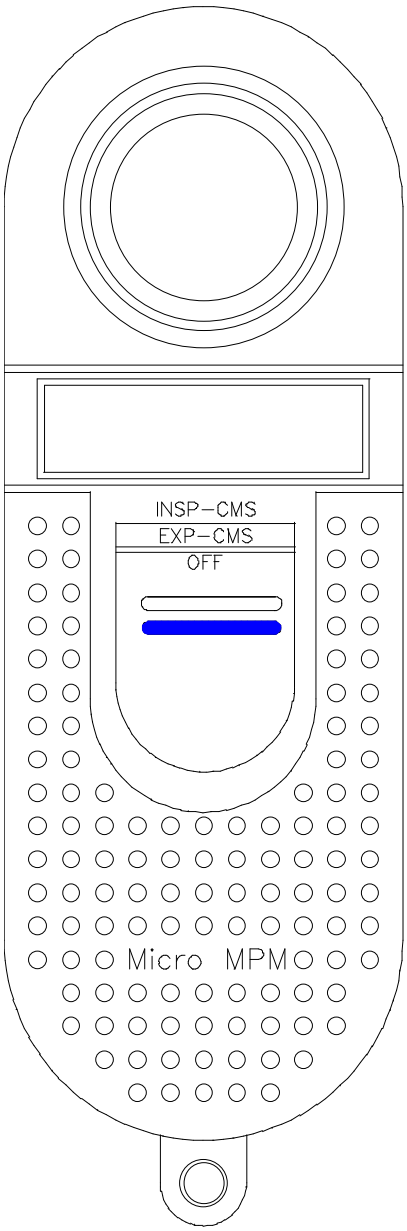

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Mouth Pressure Meter Service Manual

027-11 Iss. 1.0 September 1998

Mouth Pressure Meter

Service Manual

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Introduction

The Micro Medical mouth pressure meter comprises of a hand held electronics unit that incorporates a removable Micro Medical mouthpiece holder/insert.

The unit is designed for the rapid assessment of inspiratory and expiratory respiratory muscle strength. The result of each measurement is presented in units of cmH_2O on the Liquid Crystal Display screen on the face of the meter.

Measuring the mouth pressure created during a maximum effort against a closed airway indirectly assesses the strength of the inspiratory or expiratory muscles. The manoeuvre is therefore effectively isometric.

Operation

The Micro Medical Mouth Pressure Meter has been designed for easy operation and after fitting the battery and flanged rubber mouthpiece, the Mouth Pressure Meter is ready for use.

To measure the maximum expiratory pressure (Pemax), slide the switch on the face of the meter from the “OFF” position to the expiratory position (exp cms), and wait for the display to zero. Instruct the subject to inhale to TLC (Total Lung Capacity) and then, before exhaling, to insert the mouthpiece into the mouth ensuring that the flange is positioned over the gums and inside of the lips and that the “bite blocks” are between the teeth. For an accurate measurement it is important that there are no leaks in the system. When the mouthpiece is correctly positioned, instruct the subject to exhale with as much effort as is possible against the resistance. A small controlled leak in the system will prevent the generation of excessively high mouth pressures.

Before repeating the measurement or before performing an inspiratory manoeuvre, the instrument must be reset by sliding the switch to the “OFF” position.

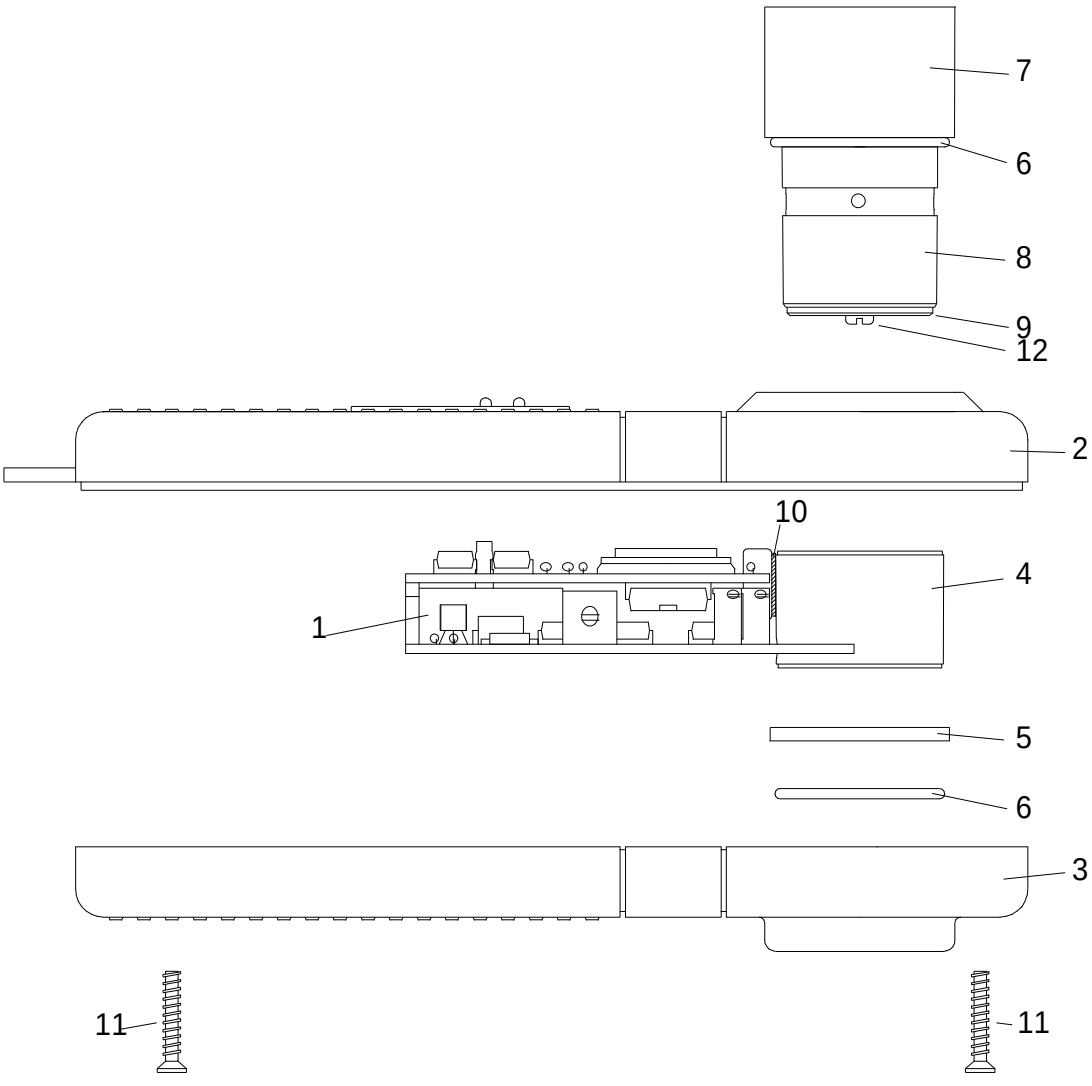
To measure the maximum inspiratory pressure (PImax), slide the switch on the face of the meter from the “OFF” position into the inspiratory position (ins cms), and wait for the display to zero. Instruct the subject t exhale to RV (Residual Volume), and then to insert the mouthpiece according to the above procedure. Instruct the subject to breathe in with maximum effort against the resistance.

It is important that the maximum effort is sustained for at least one second for each inspiratory and expiratory measurement.

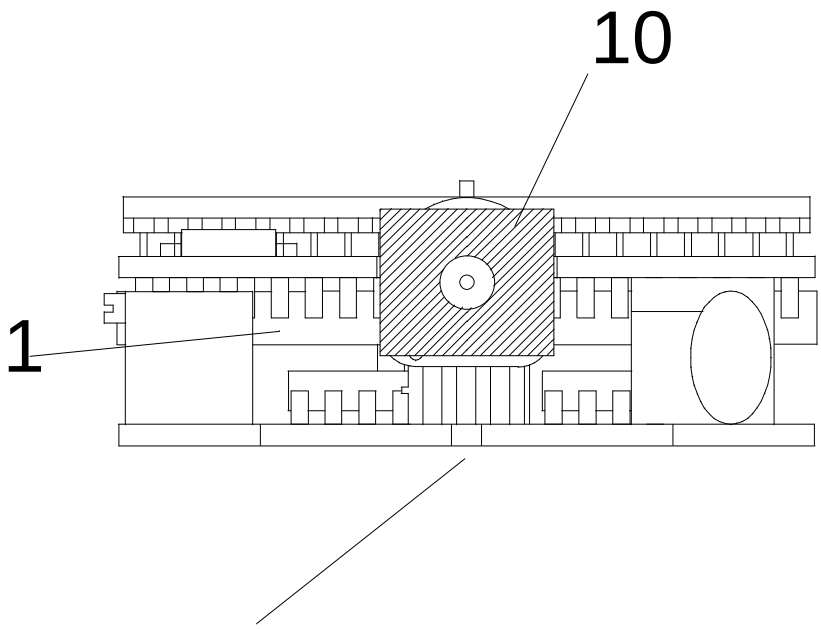
The Mouth Pressure Meter is switched “OFF” by moving the switch downwards to the “OFF” position then the display will be blank.

Mouth Pressure Meter Layout

1. Mouth Pressure Meter PCB
2. Top Moulding
3. Bottom Moulding
4. Turbine sleeve
5. Retaining ring
6. Coated O ring
7. Mouthpiece Holder
8. Acrylic tube
9. Blanking plate
10. 13mm of EMPD sealing strip with 4mm diameter central hole
11. Countersunk screws
12. M2.5 x 10mm Pan head screw



Sealing strip position



Cleaning and maintaining the Mouth Pressure Meter

The Micro Medical Mouth Pressure Meter requires no routine maintenance or servicing.

The transducer assembly may be removed from the instrument for cleaning by gently twisting the mouthpiece holder and, at the same time pulling the assembly from the body of the meter.

The assembly may be immersed in a solution of warm soapy water or a proprietary disinfecting solution. If sterilisation is required, a cold solution such as Alkacide is recommended. This must be used according to the manufacturers instructions to achieve the required degree of sterilisation. Do not autoclave the transducer and avoid the use of alcohol or chlorine based solutions. After cleaning/sterilisation, rinse the assembly in distilled water, dry thoroughly and reassemble.

Should insertion of the transducer into the holder become difficult, the application of a small amount of silicone grease to the 'O' ring, located within the holder, will facilitate replacement of the assembly.

Calibration is factory set and should remain constant throughout the lifetime of the device. However the Mouth Pressure Meter can be calibrated if in doubt by the Micro Medical Service Centre.

Disassembling the Mouth Pressure Meter.

If the Mouth Pressure Meter becomes faulty then the following procedure is needed to investigate the fault.

1. Remove the mouthpiece holder from the main unit by gently pulling the mouth piece holder from the unit with a twisting action.
2. Turn the unit face down and slide back the battery cover.
3. Remove the battery and place to one side.
4. Remove the 2 screws from the bottom moulding (Item 11) and put to one side.
5. Turn the unit face up and ease the top moulding from the bottom moulding and turn the top moulding to reveal as shown below.
6. Remove the PCB from the bottom moulding and put the bottom moulding to one side.
7. The Mouth Pressure Meter is now ready for fault finding.

Reassembling the Mouth Pressure Meter

1. Place the PCB into the bottom moulding and wire the battery lead as shown below.
2. Replace items 4,5 and 6 into the bottom moulding as shown in the Mouth Pressure Meter layout drawing.
3. Position the top moulding on top of the bottom moulding and push together. (ensure that the battery leads are not trapped).
4. Turn the unit face down and secure the unit with the retained screws.
5. Refit the PP3 battery ensuring correct polarity.
6. Slide on the battery cover.
7. Turn the unit face up and refit the mouthpiece holder.
8. The Mouth Pressure Meter is now ready for operation.

Circuit Description

Power Supply and battery monitoring

The Mouth pressure meter is powered by a PP3 9V Alkaline battery and is monitored by a battery-low detection circuit consisting of R17, R18, TR1 and ZD1. R17 and R18 form a potential divider across the battery and the voltage obtained is applied to the emitter of TR1. The base of TR1 is held at 1.26 volts by ZD1 and TR1 turns on the emitter voltage falls to approximately 0.7 volts. The collector is held high by R19 and will fall when TR1 turns on at a battery voltage of 7.5 volts. The battery low indicator on the display is normally connected to the back plane (BP) through the analogue switch, IC8C, and is not displayed. The collector of TR1 controls the switch and when the battery is low, the connection to the back plane is broken. In this case, the indicator is turned on by the connection to the inverse of the back plane through R22.

Pressure Sensor Conditioning Circuit

The mouth pressure meter consists of an internally temperature compensated solid state pressure transducer (PT1). The transducer is driven with an 840µA constant current source consisting of R4, R5, ZD1 and IC5A. The differential signal from the pressure transducer is amplified by IC1, IC2 and IC5B, set up in an instrumentation configuration, and referenced to COM. COM is a reference level output of IC6 set to 2.8 volts below the positive supply. The signal is then inverted by IC5C. The non-inverted signal from IC5B is used when an inspiratory pressure measurement is selected and the inverted signal, from IC5C, is used when an expiratory measurement is required. The selected signal is low pass filtered at 0.7Hz by C10 and R14 or R15.

Reset

When the unit is first switched on, a bi-stable circuit formed by IC9A and B is set such that the output of IC9C is low. This output is connected to the analogue switches, IC8A and B. IC8A is used to discharge the peak detector holding capacitor, C1, and IC8B is used to disconnect the input to the A.D converter, IC6. The bi-stable circuit is reset by IC7A when the signal from IC5B or C rises to 18mV above COM. This level is set by the potential divider formed by R27 and R28.

Peak detector

The signal from IC5B or C is the passed through a peak detector formed by IC3, D2, R10 and C1. As the pressure signal rises the input on the non-inverting input to IC3 is above the voltage held on the storage capacitor, C1, and the output will go high to charge the capacitor through D2. When the signal falls below the stored voltage then the output of IC3 will drop and the voltage on the storage capacitor will be held. At this time the output of IC7B will go high, causing pin 1 of IC6 to go high shortly afterwards. Pin 1 of IC6 is the HOLD input that freezes the display. This ensures that the reading will remain stable on the display indefinitely, regardless of any small drift on the storage capacitor.

A/D Convertor

IC6 is a 3½ digit analogue to digital converter with built-in LCD driver. The display consists of a liquid crystal sandwiched between transparent electrodes, representing each segment, and a back plane. The back plane is supplied with a square wave voltage with a nominal frequency of 60Hz generated on pin 21 of IC6. Each segment is connected to a pin on IC6 and is active when a voltage in anti-phase to the back plane is applied and in-active when the segment voltage is in phase with the back plane. The input to the A/D converter is on pin 31 of IC6 and is compared to the reference input, pin 36. The reference input voltage is derived from the potential divider formed by R23 and R24, which sets the sensitivity of the A/D converter.

Parts List

Designation	Description
IC1	**(MC33171P)** CMOS OP-AMP
IC2	**(MC33171P)** CMOS OP-AMP
IC3	**(CA5160E)** CMOS OP-AMP
IC4	**(CA5160E)** CMOS OP-AMP
IC5	**(LM124)** QUAD LOW POWER, SINGLE SUPPLY OP-AMP
IC6	**(ICL7116CPL)** 3 DIGIT A/D CONVERTER
IC7	**(LM393)** DUAL COMPARATOR
IC8	**(4066)** QUAD CMOS SWITCH
IC9	**(4093)** QUAD NAND GATE
R1	10K OHM RESISTOR 1% METAL FILM
R2	1K5 OHM RESISTOR 1% METAL FILM
R3	10K OHM RESISTOR 1% METAL FILM
R4	1K5 OHM RESISTOR 1% METAL FILM
R5	8K2 OHM RESISTOR 1% METAL FILM
R6	4K7 OHM RESISTOR 1% METAL FILM
R7	10K OHM RESISTOR 1% METAL FILM
R8	10K OHM RESISTOR 1% METAL FILM
R9	10K OHM RESISTOR 1% METAL FILM
R10	10K OHM RESISTOR 1% METAL FILM
R11	10K OHM RESISTOR 1% METAL FILM
R12	10K OHM RESISTOR 1% METAL FILM
R13	10K OHM RESISTOR 1% METAL FILM
R14	220K OHM RESISTOR 1% METAL FILM
R15	220K OHM RESISTOR 1% METAL FILM
R16	1K OHM RESISTOR 1% METAL FILM
R17	1K OHM RESISTOR 1% METAL FILM
R18	10K OHM RESISTOR 1% METAL FILM
R19	100K OHM RESISTOR 1% METAL FILM
R20	100K OHM RESISTOR 1% METAL FILM
R21	1M OHM RESISTOR 1% METAL FILM
R22	100K OHM RESISTOR 1% METAL FILM
R23	22K OHM RESISTOR 1% METAL FILM
R24	12K OHM RESISTOR 1% METAL FILM
R25	470K OHM RESISTOR 1% METAL FILM
R26	10K OHM RESISTOR 1% METAL FILM
R27	30 OHM RESISTOR 1% METAL FILM
R28	4.7K OHM RESISTOR 1% METAL FILM
R29	47K OHM RESISTOR 1% METAL FILM
C1	470nF POLYPROPYLENE 0.2" PITCH CAPACITOR
C2	100pF CERAMIC 0.1" PITCH CAPACITOR
C3	220nF POLYESTER 0.2" PITCH CAPACITOR
C4	47nF POLYESTER 0.2" PITCH CAPACITOR
C5	100nF POLYESTER 0.2" PITCH CAPACITOR
C6	10nF CERAMIC 0.1" PITCH CAPACITOR
C7	4.7uF ELECTROLYTIC 0.1" PITCH CAPACITOR
C8	4.7uF ELECTROLYTIC 0.1" PITCH CAPACITOR
C9	47uF ELECTROLYTIC 0.2" PITCH CAPACITOR
C10	1uF MULTI-LAYER CERAMIC 0.2" PITCH CAPACITOR
CDT(x2)	100uF TANTALUM 0.2" PITCH CAPACITOR
RN1	100K 5 WAY RESISTOR NETWORK 6 PINS
RN2	100K 5 WAY RESISTOR NETWORK 6 PINS
VR1	10K 25 TURN POTENTIOMETER

VR2	20K 25 TURN POTENTIOMETER
VR3	NOT USED
D2	(OA202) SILICON DIODE
D3	(OA202) SILICON DIODE
D4	(OA202) SILICON DIODE
ZD1	(REF12Z) 1.26 VOLT BAND GAP REFERENCE
T1	BC182LB) NPN TRANSISTOR
SW1	(SLF2300) DOUBLE POLE 3 POSITION SLIDE SWITCH

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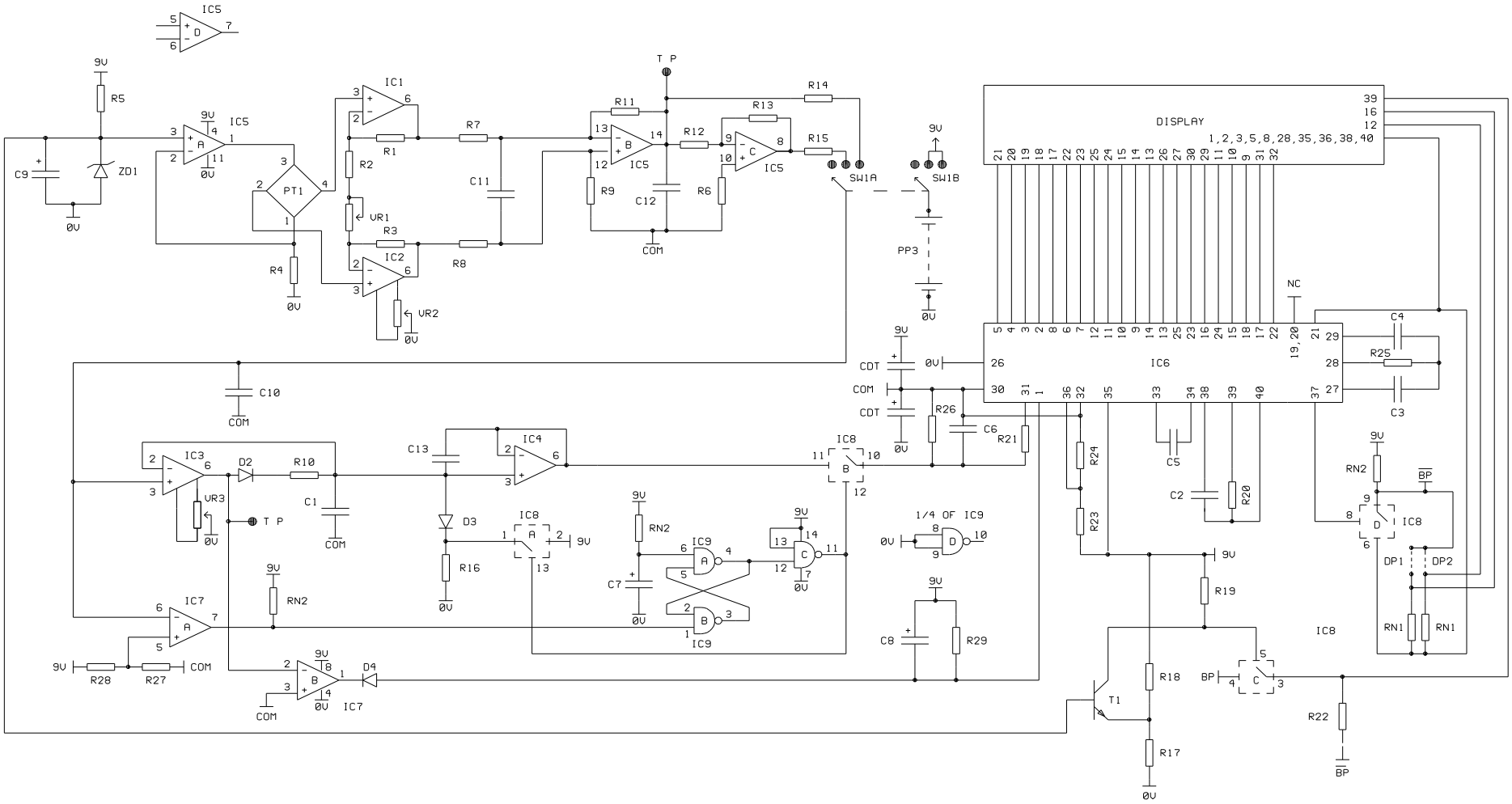

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